OUR

NATIONAL SCHOOLS OF SCIENCE.

BY

DANIEL C. GILMAN,

PROFESSOR IN THE SHEFFIELD SCIENTIFIC SCHOOL OF YALE COLLEGE.

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1. *Act of Congress, approved July* 2, 1862, *entitled* "*An Act donating Public Lands to the several States and Territories which may provide Colleges for the Benefit of Agriculture and the Mechanic Arts*"; *with the explanatory Speeches of* Hon. Justin S. Morrill, M. C. — *Congressional Globe.*
2. *Circular addressed by* Henry Barnard, *U. S. Commissioner of Education, to the Authorities in Charge of the Colleges and Schools established or aided by the Congressional Appropriation* "*for the Benefit of Agriculture and the Mechanic Arts.*" Washington. September, 1867.
3. *Report of the Committee on Organization in the Cornell University.* By Hon. A. D. White, Chancellor. Albany. 1867. 8vo. pp. 48.
4. *Report relative to establishing a State University in California.* By Prof. J. D. Whitney and others. Sacramento. 1864. 8vo. pp. 30.
5. *Scientific Education in its Relations to Industry. An Address at the* 21*st Anniversary of the Sheffield Scientific School of Yale College.* By Prof. C. S. Lyman. New Haven. 1867. 8vo. pp. 30.
6. *A few Things to be thought of before proceeding to plan Buildings for the National Agricultural Colleges.* [By Fred. Law Olmsted.] New York. 1866. 8vo. pp. 24.
7. *An Address on the Limits of Education, before the Massachusetts Institute of Technology, November* 16, 1865. By Jacob Bigelow, M. D. Boston. 1865. 8vo. pp. 28.

The influence of our recent war in developing the "national" sentiment of the people can hardly be over-estimated. It was the conclusion of a long series of conflicts between the

idea of a loose confederacy, exposed to the secession of a disaffected section, and the idea of States forever united to promote the common welfare of all the inhabitants. As the nation was vindicated in the final appeal to the decision of arms, so in a multitude of important although minor issues there has been a like assertion of the power of the people, acting through the general government, to secure for themselves benefits which cannot proceed from the action of independent States.

For example, national banks have almost superseded State incorporations, and their bills are current throughout the land. National securities have become the favorite investments, not of rich capitalists only, as heretofore, but of workingmen, farmers, mechanics, teachers, ministers, and other men of little income and less savings. A national railroad, stretching over half the continent, is in progress, to bind the East and West together. The nation has pronounced itself in favor of an international system of weights and measures. A National Academy of Sciences has been instituted. Appropriations have been made by Congress, and delegates have been sent abroad, to represent us at the exhibition of national industry in Paris. A national Commissioner of Agriculture has been appointed.

Nor has public instruction been neglected. A national Department of Education has been established, and a national Commissioner appointed to promote as far as possible the progress of sound and liberal views of intellectual culture. More than this, a vast domain, surpassing the area of many of the kingdoms and duchies of Europe, has been appropriated by Congress for the promotion, throughout the land, of industrial or scientific schools, colleges, and universities.

We shall not now discuss the tendency of such legislation, nor question how far it promotes the dignity, the prosperity, and the happiness of the United States, or how far it lessens the popular regard for States rights and the dread of a centralized government. We merely call attention to this noteworthy aspect of the times in its relations to popular education, and to the obvious fact that the withdrawal of the extreme sectional men from the halls of Congress has made it possible to mature and carry out some plans for the national welfare which in ear-

lier days would have been certainly voted down, and which in time to come, whatever be the conditions of reconstruction in the South, can never be undone.

Under these circumstances we think that the epithet employed for the first time in the heading of this article is a fit designation of a class of institutions rapidly organizing in all the loyal States. They are in fact, if not in name, the "National Schools of Science," distinguished from all other schools and colleges by the reception of an endowment from the nation, obliged to conform to certain requirements of the national legislature, and bound to print and publish annually a report of their progress. It is true that the general government has no other control over them than to insist upon a fulfilment of the requirements of the statute by which they were created. But the nation gave birth to them; the nation provided their dowry; the nation is to reap the benefits which they are designed to render.

Very few persons understand the momentous significance of the Act of Congress "for the Benefit of Agriculture and the Mechanic Arts," which was passed by Congress on the 17th of June, 1862, and became a law, by the approval of President Lincoln, on the 2d of July immediately following. Our New England readers will associate the earlier of these dates with the anniversary of the battle of Bunker Hill, the earliest occasion on which the force of the national arms and the self-determining power of the American people were exhibited to the world. Hereafter the same anniversary will recall to the minds of scholars the earliest act of Congress for the promotion of national popular education. Other grants there have been, we are well aware, for purposes of instruction, but this is the first which regards the wants of all the States.

It is very remarkable that so important a measure should have been carried through the House of Representatives by its friends under the operation of that summary procedure in parliamentary tactics known as "the previous question." The only broad and statesmanlike speeches, on the general principles of the bill and the probable influence of its enactment, were made by the author of the measure. Many other persons spoke upon the subject, especially in the Senate, but nearly all that was said had reference to minor points involved in the

general plan, and had little regard to its characteristic features. So, too, in the several States of the North there has been but little general conference or inquiry or discussion respecting the educational necessities of the country. Each State is solving the problem of what to do with the public grant in its own way, with reference to its own wants, and according to its own understanding of the Congressional intent. Some persons may not object to this, but will point to it as one of the many illustrations of the self-confidence and promptness of action which distinguish our countrymen. We are not sure that this mode of procedure is the best.

We cannot but regret that an educational problem so important as that which is involved in the establishment of these National Schools of Science is to be settled, at any rate for a time, with so little comparison of views among the educators of the country, and so little discussion of the principles of mental training. A grant of land, imperial in extent, is devoted to the creation and encouragement of five-and-twenty colleges, one in each of the loyal States, which are to be followed, it is probable, by the creation of five-and-twenty more in the reconstructed States of the South and the newly admitted States of the West. These colleges are to differ from most of those already established, in the classes of persons for whose special benefit they are founded, and in the modes of instruction they will employ. Yet there is no public conference of scholars or statesmen respecting the legitimate scope of the institutions; no inquiry in regard to the wants of this country or the experience of others; no sharp and clear announcement even, in the act of Congress which confers the grant, of the character to be aimed at in the new establishments; no thorough discussion in the periodicals of the day respecting the changes which are possible and desirable in the national education. All at once the country is involved in perplexing inquiries. The problem is complex as well as difficult, requiring time not less than wisdom to solve it. It involves so many unknown quantities, that well-defined conclusions cannot be reached at once, if indeed they are ever to be attained. The broadest culture, the deepest insight into the laws of intellectual progress, a thorough appreciation both of science and of letters as means of disci-

pline, and a sagacious power of adapting means to ends, are essential to the wise determination of the questions involved in the establishment of these institutions.

But, as usual, this country cannot wait for the slow gathering of wisdom. "Something must be done." The land has been granted, the schools must begin. Stated in its barest form, the problem to be solved is this: *How can the methods and results of modern science be made most conducive to the education of American young men?* Stated in its fullest expression, there is no point in the theory of intellectual discipline and the methods of human culture which the problem does not involve.

"This is a republic where the will of the people is the law of the land," says our highest military leader to the highest public functionary of the land. It is true in education as in politics and war. The people hold the power, the people will decide upon the methods. They will blunder, they will experiment, they will try exploded notions, but they will never lose sight of the end in view. They will secure "the liberal and practical education of the industrial classes." When that is accomplished, and not till then, universal education will be the characteristic of the continent, as in earlier days it has already been of some portions of New England.

We regard it as a promise of future good, that the new "Department of Education" in the general government at Washington has been first intrusted to one of the most experienced and enlightened advocates of public instruction in this country, and that one of his earliest official proceedings is to seek out and bring together the results during the last five years of the action in the different States respecting the Congressional appropriation for the purposes of national education. The circular mentioned at the beginning of this article presents a series of questions addressed to the authorities of the new Schools of Science, and when their returns are received we shall have a curious and instructive chapter of educational experience. The circular also contains copies of the original enactment of Congress, and of many of the separate State enactments upon this subject, with full accounts of two institutions already in vigorous progress. In no other place can so much be seen of the method in which the Congressional grant has been applied.

The titles of other pamphlets which we have prefixed to our remarks are selected from a large number which we might have given, as affording a good idea of the character of discussions which are now in progress. We shall not remark on them separately, for our intention is to present the general rather than the local aspects of the subject we have taken up. Prior to the bestowal of the Congressional grant, schools of science, under various designations, had been established in various places, and many of the older classical colleges had arranged for partial or optional courses of study, which were supposed to be called for by students who would not devote themselves to Latin and Greek. Some of the largest of the large endowments which have been bestowed on educational institutions in this country have been directed to institutions of science rather than of literature. The names of Stephen Van Rensselaer, James Smithson, Abbott Lawrence, Peter Cooper, Joseph E. Sheffield, Abiel Chandler, Blandina Dudley, and George Peabody will remind the reader of a series of princely gifts, the object of which has been to promote the knowledge of natural science among our countrymen. Most of these donors had acquired their own fortunes, and had clearly seen the value of training in mathematical, physical, and natural science as a preparation for life, as well as the importance of scientific researches in promoting the development of our natural resources. Other kindred benefactions might be named, but those now cited are enough to show that, independent of what the government might do, schools of science were not likely to be neglected by the people of this country.

The pioneer among these scientific schools was that at Troy, founded by the late Stephen Van Rensselaer, and long under the direction of Amos Eaton, the well-known naturalist. It was reorganized in 1850 as a special school of architecture and engineering. For a long time it stood alone. The gift of Abbott Lawrence to Harvard College, in 1847, for the foundation of a scientific school, attracted very general attention; and within a few years, at Harvard, at Yale, at Dartmouth, at Union, at Columbia, and at some other younger colleges, scientific schools were established, nominally on the footing of the professional schools of law, medicine, and theology, but

practically (in some instances at least) affording to the scholars a course of study parallel, but by no means equal in discipline, to the usual college course.

In New York, Pennsylvania, Michigan, Illinois, and other Western and Central States, vigorous efforts, with more or less success, had been put forth to organize agricultural schools, which should train practical farmers for their work, and should help forward the science of agriculture by investigations and experiments. An "Institute of Technology," on a very liberal plan, had been projected in Boston, having reference, though by no means exclusively, to the training of mechanical engineers and others engaged in manufacturing occupations.

Under all these different forms there may have been, when the Congressional Endowment Bill was passed, twenty institutions which could be grouped under the general title of scientific schools. They were variously termed, in popular or official phraseology, scientific schools, polytechnic schools, technological schools, agricultural schools; and they differed as much in worth and in influence as they did in name. In one respect they were alike: they were all imperfectly endowed. Most of them were also on an experimental basis, — no person being able to say exactly what they might, could, or should be. Still they were very significant indications of the spirit of the age. They showed a desire for an advanced education on some other basis than the literature of Greece and Rome. They showed the willingness of rich men to give to scientific colleges. They showed the popular craving for what was vaguely termed, for want of a better word, a *practical* education. They showed that, in some form or other, provision would be made for education in those branches of useful knowledge which tend to exhibit the Creator's works in their true aspects, and likewise in those which are immediately connected with the material advancement and civilization of mankind.

Such, in brief, was the provision made for scientific education in this country at the time when Congress gave a new and definite impulse to the movement. The private influences which were at work urging on our representatives at Washington to encourage "agricultural schools" by a gift of public lands, we cannot here attempt to rehearse. There were busy

and devoted men in New York, Pennsylvania, and Illinois, who spared no effort within their power to secure a national appropriation.

The history of Congressional action on this subject begins with the assembling of the Thirty-fifth Congress, in December, 1857, at the outset of Mr. Buchanan's administration, in the days of Kansas outrages, — the beginning of the end of the dominion of slavery. On the 14th of December, the chairman of the Standing Committee on Agriculture, Mr. Justin S. Morrill, introduced a bill appropriating to the several States a portion of the public lands, for the purpose of encouraging institutions for the benefit of agriculture and the mechanic arts. Opposition manifested itself at once, and the bill, instead of being referred, as the author desired, to the Committee on Agriculture, fell into the hands of its enemies in the Committee on Public Lands. Four months later, on the 15th of April, 1858, the chairman of the latter committee, Mr. W. R. W. Cobb of Alabama, reported back the bill, recommending that it should not pass. Mr. Walbridge of Michigan, from the same committee, presented a minority report favoring the measure. The introduction of the subject at this time led to very little debate or inquiry in respect to the various sections of the bill. Its author appeared determined that it should pass or fail to pass, *as a whole*, and that it should not be altered and ruined by attempts to satisfy all possible objections to its features. He made the only elaborate speech in its favor, and Mr. Cobb made the only effective speech in opposition. The "previous question" was ordered by the House, and the bill was called by the very small majority of one hundred and five to one hundred. A change of three votes would have killed it. This occurred on the 22d of April, 1858.

The Senate also referred the measure, when it came from the House, to the Committee on Public Lands, and they reported it back, without advising either its rejection or its passage, and Congress adjourned without action having been taken on the part of the Senate. Two months of the following winter passed by before this bill was reached. Then, by the energetic efforts of Senators Wade, Harlan, and Stuart, and in spite of the opposition of Senators Jefferson Davis, J. M. Mason, and

Pugh, the bill, slightly amended, was passed, by a vote of twenty-five to twenty-two, on the 7th of February, 1859. A change of two votes in the Senate would have defeated it. The House concurred in the amendments which had been made, and the bill went to the President. It soon came back with his veto. The objections which he raised, partly of a constitutional and partly of a theoretical character, were forcibly put; and they may be consulted by those interested in the history of the bill as a clear and strong statement of the views of the opposition.

When the bill returned to the House, it could not be expected that a two-thirds vote could be secured over the President's veto. On putting the question, the advocates of the measure stood firm, one hundred and five ayes; four of the opponents were gone, and the noes were ninety-six. So the bill was not passed.

Nothing illustrates the changing aspect of affairs throughout the land better than the legislation of the Thirty-fifth and Thirty-sixth Congresses respectively. In the new Congress of President Lincoln's administration, the very same bill which had failed before was introduced to the Senate by Senator Wade, on the 5th of May, 1862. It went to the Committee on Public Lands, and, eleven days later, was reported back favorably by Senator Harlan. For a month its fate was pending in the Senate. Its opponents asked for delay, and raised objections, not only to its general principles, but to specific provisions. On the 10th of June a vote was reached, and the Senate, by a vote of thirty-two to seven, passed the bill. The minority was composed of Senators Doolittle, Grimes, Saulsbury, Wright, Howe, Lane, and Wilkinson, — the three last named having taken the most active share in the debate.

The bill went to the House, and, without any other debate than an able speech from its author, Mr. Morrill, was adopted by the decisive vote of ninety to twenty-five. This occurred, as we have said, on June 17, 1862. In a few days it received the signature of Abraham Lincoln, and became a law of the land.

Thus, after nearly five years of Congressional delay and opposition, the author of the bill and its earnest advocate had

the satisfaction of seeing accomplished a most important service to the people of this land. We give a summary of the act in its author's own words.

"The bill proposes to establish at least one college in every State upon a sure and perpetual foundation, accessible to all, but especially to the sons of toil, where all the needful science for the practical avocations of life shall be taught, where neither the higher graces of classical studies, nor that military drill our country now so greatly appreciates, will be entirely ignored, and where agriculture, the foundation of all present and future prosperity, may look for troops of earnest friends, studying its familiar and recondite economies, and at last elevating it to that higher level where it may fearlessly invoke comparison with the most advanced standards of the world. The bill fixes the leading objects, but properly, as I think, leaves to the States considerable latitude in carrying out the practical details."

An analysis of the act, sufficiently full for the general reader, may be given in the following terms: —

I. Every State may receive a quantity of public land equal to thirty thousand acres for every one of its Senators and Representatives in Congress, under the census of 1860.

II. The mode in which this land may be selected and located is restricted by various provisions, the most important being that no State may locate its scrip within the limits of another State, — although its assignees may do so.

III. All expenses of location, management, taxation, etc. must be paid from the State treasuries, in order that the entire proceeds of the sale of lands may remain undiminished.

IV. The proceeds are to be invested in safe stocks, yielding at least five per cent per annum, and the interest "shall be inviolably appropriated, by each State which may take and claim the benefit of this act, to the endowment, support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the Legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life."

V. This grant is made on the following conditions: — 1. Each

State shall guarantee the entire capital of the fund it receives, except that one tenth of the capital may be devoted to the purchase of a site or of a farm. 2. No part of the fund or the interest thereof may be applied to building or repairs. 3. Any State receiving the grant must provide an institution within five years. 4. An annual report shall be made and distributed. 5. If lands improved by railroads are selected, the number of acres will be diminished. 6. No State while in rebellion may have the benefit of this act. 7. No State may receive the grant unless its Legislature formally accepts it within two years of its approval by the President.

VI. Certain provisions are made respecting the location of the land-scrip, and the reports to Congress of sales, appropriations, etc.

Some modifications of the law, not affecting its general characteristics, have been subsequently made by acts of Congress, approved April 14, 1864, and July 23, 1866. By the latter, the time in which a State may signify its acceptance of the grant is extended to three years from the date of the amendment, that is, to July 23, 1869, and Territories (which were not included in the original measure, though mentioned in its title) are allowed three years after their admission as States within which they may avail themselves of this national bounty. The time within which every State must establish at least one college is also somewhat extended. The tenor of these amendments is obviously such that the rebellious States of the South and the coming States of the West, so soon as they are received into good and regular standing as States, may share in the benefits now enjoyed by the old and loyal members of the Union. Thus the grant becomes completely national, and cannot by any possibility be construed into a favor bestowed in time of war for the special benefit of the North.

The law, then, contemplates the early establishment and endowment of not less than thirty-seven national schools of science. Including the Territories as now organized, this number rises to forty-four, that being, according to our count, the present number of States and Territories, loyal and disloyal, which constitute the Union, — not including Sitka. Any State

may elect, however, to establish more than one of the proposed colleges, and the number of Territories is sure to be increased. It is safe, therefore, to say that Congress has provided for the institution of nearly fifty colleges on a national basis. Let us now look more closely into the terms of this enactment.

Among the ideas which are often advocated in this country, but which are wisely kept out of the Morrill bill, are many crude and rash notions in respect to the objects and methods of instruction. Many persons, aiming to benefit the industrial classes, would have insisted on some particular form of institution to be adopted in every State, and would have hampered the bill with objectionable features. In proof of this, we need only turn to a pamphlet published by the Agricultural Department at Washington, with strong official commendation, in which the writer gives such directions as these: — "Let the model farm comprise, if practicable, *exactly* one hundred acres, and be of a regular shape." Let this be divided into portions comprising "*exactly* ten acres." One of these parallelograms, "the model garden," may be laid off "on the plan of Mercator's Projection, so that the prime meridian may pass through Behring's Straits"; the buildings will then "occupy the central vacancy in the Pacific Ocean, while each seed sown and shrub or bulb planted may be made to grow on such representative spot in the garden as it occupied in its native soil.' Even if there were no danger that such extravagances as these would find place in legislation, it would not have been surprising if a spite had been shown against Latin and Greek, or a predilection for manual labor, or a determination that a farm should in all cases be secured. Some advisers would have thought it essential that the general government, in providing the endowment, should perpetually exercise the right of inspection or direction. Military men might have been tempted to insist on a military organization for the discipline of the students. But all such objectionable restrictions are happily omitted from the act of Congress. It contains everything which is essential, and nothing which is unessential, to the end in view. The people of every State are left free to determine how the scientific education of the industrial classes may be most efficiently promoted within their several limits.

The most noteworthy phrase in the bill is the clause which defines the character of the projected institutions, and which we have quoted *verbatim* in the fourth paragraph of the above analysis. It states in the clearest terms that the object of the national liberality is to provide instruction in "such branches of learning as are related to agriculture and the mechanic arts, without excluding other scientific and classical studies, and including military tactics." It does not seem possible to misapprehend this statement. Yet every week we are surprised to find that this broad and comprehensive basis of the grant is not understood, even among intelligent men, who should be correctly informed. The act is almost always called "The Agricultural College Bill," which is as truly a misnomer as if it were called "The Public Lands Bill." In the Indexes of the Congressional Globe and of the United States Statutes at Large, in the laws of most of the separate States, in the official messages of Governors, Comptrollers, and the like, "Agricultural College" is the term employed to indicate the essential feature of the law. This is an error, — an injurious and dangerous error, likely to lead to many popular complaints respecting the institutions established by Congress. Even so intelligent a writer as the accomplished Farmer of "Edgewood," in one of his latest volumes, gives an undeserved fling at the teachers in our agricultural colleges, based on the erroneous impression that only agriculture should be taught in these national schools of science. The mechanic arts, however, are placed on the same footing as agriculture, and the *liberal education* of the industrial classes is as much an object of the grant as their practical training. In short, any branch of human learning may lawfully receive attention in these schools, provided only that it does not preclude attention to the study of natural science in its applications to human industry. Even a university with all its faculties may be maintained with the proceeds of the grant, if they are adequate to such an outlay, provided always that the promotion of agriculture and the mechanic arts is kept prominently in view.

The popular misapprehension requires correction. If the title "National Schools of Science" does not find favor, let the term "Colleges of Agriculture and the Mechanic Arts,"

"Industrial Universities," or the more familiar and indefinite phrase "Scientific," "Polytechnic," or "Technological" School, be substituted; but let not the inaccurate and incomplete designation "Agricultural Colleges" continue to find favor. It has already led, in some places, to unpleasant discussions with farmers and their friends, who have claimed all the advantages of the grant, without reference to the many other "industrial classes" in the community. The truth is, that in our country all belong to the industrial classes. All are intent on work. No birthright, no entailed estate, no aristocratic title, no official position, exempts the American from laboring with brain or hand, or with brain and hand, for the benefit of his fellow-men and the promotion of the general civilization. It is the comprehensiveness of the Morrill bill which constitutes its highest excellence. At the same time, while we insist upon the catholicity of this measure, we cannot and would not overlook another fact which is just as clear. Scientific schools, not classical colleges, are established by the act. The terms of the law, the explanations of its author, the intent of its supporters, unite in showing this beyond a doubt. Mathematical, physical, and natural science, the investigation of the laws of nature, are to be the predominant study, rather than language, literature, and history. The latter may be, the former must be, included. No slight is cast upon the classics, the venerated means of human culture, the acknowledged instruments of high intellectual discipline. They may hold their place; but other studies must predominate in the new institutions. In other words, the general government lends its co-operation to the development of the national wealth, and bestows its bounty on institutions in which men of all political, ecclesiastical, and religious opinions may, if they will, unite.

A third point to be considered in the provisions of the Morrill bill is the magnitude of the domain set apart for these new institutions. The enactment furnishes them with a truly magnificent endowment, especially in the more populous States, and will enable them in their youth to outstrip in dignity and influence many of the older half-endowed colleges which are struggling for existence. The following table exhibits at a glance the number of "portions" each State is entitled to re-

ceive, and also the total number of acres. The reader will remember that thirty thousand acres is allotted for every Senator and Representative in Congress. It is not absolutely certain that all the States will accept the grant, but there is hardly a doubt that such will be the case. Delays in "reconstruction" afford the only occasion for doubt.

TABLE.

States.	Senators and Representatives in Congress.	Acres in Scrip.	States.	Senators and Representatives in Congress.	Acres in Scrip.
Alabama,	8	240,000	Missouri,	11	330,000
Arkansas,	5	150,000	Nebraska,	3	90,000
California,	5	150,000	Nevada,	3	90,000
Connecticut,	6	180,000	New Hampshire,	5	150,000
Delaware,	3	90,000	New Jersey,	7	210,000
Florida,	3	90,000	New York,	33	990,000
Georgia,	9	270,000	North Carolina,	9	270,000
Illinois,	16	480,000	Ohio,	21	630,000
Indiana,	13	390,000	Oregon,	3	90,000
Iowa,	8	240,000	Pennsylvania,	26	780,000
Kansas,	3	90,000	Rhode Island,	4	120,000
Kentucky,	11	330,000	South Carolina,	6	180,000
Louisiana,	7	210,000	Tennessee,	10	300,000
Maine,	7	210,000	Texas,	6	180,000
Maryland,	7	210,000	Vermont,	5	150,000
Massachusetts,	12	360,000	Virginia,	10	300,000
Michigan,	8	240,000	West Virginia,	5	150,000
Minnesota,	4	120,000	Wisconsin,	8	240,000
Mississippi,	7	210,000			
				317	9,510,000

From the foregoing table it appears that the total number of Senators and Representatives in Congress is three hundred and seventeen, so that this number represents the possible allotments of land-scrip without reference to claims from Territories like Colorado and others which are soon to become States. Thus a total of nine million five hundred and ten thousand acres of land is set apart for the promotion of scientific education. It appears safe to estimate that this will yield, on the average, one dollar per acre, although much has been already sold at a lower price, and the market value of the scrip is very much below a dollar.

Some of the States have taken measures, directly or indirectly, to dispose of their scrip, or to locate lands within their

own limits, in such a way as to secure a very much larger amount than a dollar per acre. In New York, for example, Mr. Cornell of Ithaca has taken the scrip at its market value, and is now devoting his rare financial ability to the disposal of it, in such quantities and on such terms as will enormously increase the proceeds, which he bestows on the institution, already endowed by a gift from his private purse of half a million dollars.

If our estimate is not too large, (and we feel confident that unless there is bad management it will be too small,) Congress has provided funds which will amount to ten millions of dollars for the endowment of the thirty-seven new colleges. The bounty of the several States and of private individuals is likely to make large additions to this amount. To begin with, the buildings must be provided from other sources than the national gift, and local generosity is not likely to stop with providing the house for so welcome a resident.

The smallest States receive for their share of the public domain ninety thousand acres. Twenty-one States receive over two hundred thousand acres each, and three receive over five hundred thousand acres. The Empire State gains the lion's share, nearly a million acres, — nearly three times as much as Massachusetts, and more than five times as much as Connecticut. If the land were in one parcel, it would make a territory of fourteen thousand eight hundred and fifty-nine miles, equal to the States of Massachusetts, Rhode Island, and Connecticut combined, and larger than either of the three kingdoms, Holland, Belgium, and Hanover.

Moreover, the proceeds of this gift are to be invested in permanent funds guaranteed by the several States. One tenth may be taken for sites or for farms, but no more, — not a dollar for bricks and mortar. Hence the entire capital, or at least nine tenths of the capital, will remain forever secured for the national schools or colleges of science.

A fourth point, which is worthy of special remark, among the requirements of the act, is the obligation of every institution to prepare an Annual Report, and to send copies of the same to all kindred institutions in the land and to the Secretary of the Interior. This secures publicity, — the safeguard

of all endowed institutions. The whole country will know what is done in every State to give efficiency to the Congressional grant, and the experience of every locality will be at the service of every other. This alone is a great protection against blunders and errors, as well as against improper appropriations or squanderings of the income.

Other points involved in the bill are worthy of consideration, but we have now considered its most significant features. A more liberal or a wiser educational endowment it would be hard to find proceeding from any government on the face of the globe.

The influence of Congress terminates, as we have already said, in these general regulations, all details of organization and management being left to the several States. By means of the laws collected in the Circular of the Department of Education, it is possible to trace out the second phase in this remarkable history, and to see in what different ways, from Maine to California, the same idea has been worked out. We should exhaust the space at our command if we undertook to give a complete narrative of the legislative enactments and discussions in the twenty-seven loyal States. We therefore refer the reader to the pamphlet just mentioned for accurate copies of what may be termed "the charters" of the institutions yet established, while we restrict ourselves to some points of comparison which are interesting and instructive.

The earliest question which has arisen in nearly or quite every State has been the expediency of establishing one or more than one national college with the proceeds of the grant. It was natural that, in States where several classical colleges were already in existence, all inadequately equipped, some hesitation should be felt about beginning a new institution, and that each existing college should desire to receive a portion of the endowment for industrial or scientific instruction. In New York such claims were earnestly urged upon the attention of the Legislature, and were skilfully answered by Mr. White (now Chancellor of Cornell University), in a speech in the Senate of that State, in March, 1865. We have thrown away, he said, in the collegiate system of New York, "the benefits arising from concentration of higher educational effort, and

have accepted the evils arising from scattering and division, until, instead of one or two strong institutions, we have a score of small colleges, each feeble, each poor, each incompletely equipped, each obliged to resort to continual beggary, each forced to abate something from thorough discipline."

Similar arguments against a division of the grant may be found in Professor Whitney's California Report, and in the Reports of Professor J. B. Turner of Illinois (who is known in that State as the pioneer advocate of industrial education), and also expressed in terms of great eloquence and force in a message of Governor Andrew to the Legislature of Massachusetts. These views have generally prevailed. In every State but one, the grant has been concentrated on a single institution. In Massachusetts alone, to the surprise of the rest of the country, a division was thought wise, and two institutions, one of agriculture, and the other of the mechanic arts, are already in successful operation. This, however, must be admitted, that the evils of division will be less serious in Massachusetts than in almost any other locality.

A second question, closely connected with the first, has been the wisdom of combining the national school with some already existing institution. In this respect, also, the friends of concentration have generally triumphed, — not always by bestowing the grant upon a corporation already existing, but commonly by creating a distinct corporation, and then locating the new institution adjacent to, or in connection with, some older college.

In New England, for example, all the States but Maine have placed the industrial colleges where the advantages of libraries and museums already collected may be freely made use of. In New Hampshire, though a separate corporation is organized, the "Agricultural and Mechanical College" is to be in fact a department of Dartmouth College. Vermont brings her scrip to the University at Burlington. Massachusetts gives one third of her grant to the Institute of Technology in Boston, and two thirds to an agricultural school established near Amherst College. Rhode Island bestows her scrip on Brown University. Connecticut finds in that department of Yale College known as the Sheffield Scientific School just such an institution as was

described in the act of Congress, and invigorates it by the gift of the national bounty. New Jersey follows the example of Connecticut, and bestows on the Scientific School of Rutgers College her share of land.

In Pennsylvania, Maryland, and Michigan, where agricultural colleges were already in successful operation, they have secured additional strength by the new endowment. In some of the Western States, the State Universities have been the recipients of the grant; for example, in Wisconsin and Kentucky. In other States, as West Virginia, Indiana, Iowa, Minnesota, Illinois, and California, it appears that new agricultural and mechanical colleges are to be organized, and not necessarily in connection with older institutions.

One State alone, the Empire State, has made the national grant the basis of a new University, distinct from all existing institutions in the State, and likely at an early day to eclipse them all in wealth, in collections, in instructors, and in students. A citizen of Ithaca, Hon. Ezra Cornell, offered to the State two hundred acres of suitable land, and half a million of dollars in money, provided that the Legislature would concentrate the national gift and his gift in a new University at Ithaca. The offer was accepted, and a scheme for the organization of the "Cornell University" is projected in a pamphlet of the Chancellor, which we give in our caption.

A third question has often arisen in respect to the desirability of procuring farms for the several colleges. In most of the States it has been thought expedient to do so, and permission to make the purchase has been granted by the Legislature. But among many of the wisest friends of agricultural improvement grave doubts are entertained whether a college farm can be wisely and economically administered. If it does not pay its expenses, farmers will be likely to scoff at "book larning" as very good for lawyers, but very poor for those who till the soil, and Legislatures will censure the management of a "model" farm which does not pay its own way. On the other hand, if experiments are to be made, the idea that they will pay expenses is as absurd as to expect that expenses will be paid by the experiments of a chemical lecture-room. Our Legislatures are so largely made up of gentlemen from the rural

districts, that we apprehend more disappointment and trouble in this particular than in any other. There will be great danger of complaints, whatever course may be adopted in the management of school farms.

We refrain from further inquiry into the action of the Legislatures in order to devote our remaining space to some of the grave questions which arise in the actual organization of the schools. In most cases the charters point out only in the most general terms the requisite characteristics, leaving all the details to the trustees and faculties. No other course would have been justifiable. But it is precisely here that some of the greatest difficulties and the most serious differences of opinion begin to appear.

Two critical epochs have been passed, — the Congressional and the Legislative. Now comes the third, the period of development, more critical and embarrassing perhaps than either of the others. Funds and charters have been provided, but they will not make a college. Regulations, courses of study, teachers, buildings, collections of books and apparatus, — all that pertains to the actual instruction of young men is still to be provided. We hazard little in saying that at the present moment more men of intellectual vigor are at work upon the problem of what these schools should be, than at any previous time in the history of the movement. In the hope that we may possibly be of service to some of them, we shall offer a few suggestions based on a comparison of all the reports and pamphlets which have come before us, and on the experience derived in organizing one such institution.

We regard it as highly important that the scientific schools of Europe should be understood in this country. The number, variety, peculiarities, and excellence of such institutions, on the Continent especially, are imperfectly understood by the people at large. Their influence, in the first place, on the advancement of science and its application to human industry, on invention and discovery, deserves to be unfolded; and in the second place, their influence on the training of manufacturers, agriculturists, miners, engineers, architects, for the various positions of the industrial world. Such schools abroad are liberally endowed, and are adapted to the wants of different

classes of students, — to those who are competent to pursue the highest scientific investigations, and to those who seek only a technical preparation for active life. We need very much at the present moment an examination of the influence of foreign scientific institutions in promoting the efficiency of industrial undertakings.

In England such an inquiry has been recently advocated, because it is thought that the International Exhibition in Paris of 1867, like that in London of 1851, reveals the fact that England is making less progress in manufacturing and mechanical industry than other European countries. Dr. Lyon Playfair, whose excellent pamphlet on "Industrial Education on the Continent," was of great use a few years ago, both here and in his own country, has recently called the attention of Lord Taunton, chairman of the Schools Inquiry Commission, to this subject.* He undertook to inquire into the causes of English inferiority, and found that among intelligent men "the one cause upon which there was most unanimity of conviction was, that France, Russia, Austria, Belgium, and Switzerland possess good systems of industrial education for the masters and managers of factories and workshops, and that England possesses none." Professor Tyndall confirms this opinion, and says that "he has long entertained the opinion, in virtue of the better education provided by the Continental nations, that England must one day, and that no distant one, find herself outstripped by those nations both in the arts of peace and war." Americans are apt to point to our reapers, sewing-machines, pianos, telegraphs, and other ingenious contrivances, in evidence of the rapid and successful development of national industry; but this proves nothing in respect to industrial education. If to the ingenuity of the New World, the thoroughness, the patience, and the science of the Old could be added, far greater results might be expected than those we now attain.

When Dumas, the celebrated chemist, says Dr. Playfair, saw anything excellent in the French Exhibition, his invariable question was, "Was the manager of this establishment a pupil of the École Centrale des Arts et Manufactures?" and in the

* See the Chemical News, August 16, 1867, p. 89.

great majority of cases he received an affirmative reply. It would be well if the characteristics of that school, of the Conservatoire des Arts et Metiers, of the School of Mines at Freiberg, of the Bauakademie at Berlin, the Polytechnic School at Dresden, and other first-class establishments, were well understood by those who are called upon to manage our incipient institutions.

At the same time, we do not believe in copying any foreign institution. The classical colleges of this country are the growth of this country. The technical colleges should be equally our own, adapted to our other institutions, our common schools, our modes of life, our national necessities. If they are not American colleges, they will not suit American students. Let us carefully study all that is good in the institutions of other countries, and adapt it so far as possible to our circumstances and needs.

Again, it seems to us very desirable that each of these State institutions should have its special and peculiar characteristics, its individuality. It will be a great pity if any one of them becomes so conspicuous for its excellence that all the others copy it. The wants of the country are various; each school should aim to supply some particular necessity, and should strive to be strong in certain directions. The older States will probably make their requirements for admission higher, and their courses of study more rigid and difficult, than the newer States. So, too, it will be well if the particular characteristics of each State receive attention in the organization of its school. In the agricultural States of the West, agriculture will naturally be prominent. In California, Nevada, Pennsylvania, the mining interests should receive particular attention. At the East the methods of education should be specially adapted to the instruction of engineers, mechanics, and chemists, and the directors and superintendents of great manufacturing establishments.

Where there is a university organization, the constant effort should be made to educate men of science, able to investigate, competent to teach, proficient in specialties. At all events, each institution should have a definite and declared object which everybody understands; there should be great caution

about undertaking too much, and so doing nothing well ; and it ought to be apparent, as the years go on, that among these national institutions provision is made for all the wants of the nation in technical education.

We observe a tendency, already manifest in a considerable degree, to mark out on paper long lists of " chairs " which it is proposed to fill. But in our opinion it is not half so important what the professorships as who the professors are. It is the men who make the college, not the titles of the catalogue. In a new and unorganized institution, the same person, though it may not be pleasant to him, may be obliged to teach several things. It is the ill luck of a new institution. But a corps of instructors, young, manly, thorough, truth-loving, able to teach, speak, and economize, will do more to give character and success to a foundation which is still dependent upon the favor of the people, than a corps of older men, who may have been titular professors for a quarter of a century, but who are not possessed with the spirit of modern inquiry. If those who are called upon to man the national colleges can secure a harmonious body of instructors, each able to do something beyond his specialty, and eager for the general good, success may be expected, but hardly otherwise. Our greatest fear at the outset of these institutions is, that a sufficient number of really competent teachers cannot be found in the country ready to manage them. It will be well for the older States to make a point of training professors for the various openings which are sure to be waiting for qualified men to fill them.

In regard to buildings, we seem fated in this country to sink large sums of money in unsatisfactory and often ill-designed buildings. The Smithsonian Institution, the Yale School of the Fine Arts, the Troy University, Vassar College, are among the instances which occur to us, where sums quite disproportionate to the remaining endowments have been invested in stone and brick. Congress has forbidden the use of the public money in the erection of college halls, but there is danger that other funds will be absorbed in injudicious structures. The admirable pamphlet of Mr. Olmsted, entitled " A few Things to be thought of before proceeding to construct Buildings for the National Agricultural Colleges," contains so many excellent hints on the

matter of college architecture, that we heartily commend it to all who think of building. His suggestions in respect to the construction of several small buildings on the college farm, rather than extensive brick barracks, and in respect to making college residences attractive homes, are worthy of general adoption. We hope to see them everywhere followed.

The predominance which will of necessity be given to scientific studies renders it important to be watchful that the study of language is not undervalued in the national institutions. No better discipline for the mind can be found than that which comes from a careful philosophical study of the modes of expressing thought. The study of Latin, at least to the extent of reading Cicero and Virgil with ready accuracy, is, on many accounts, of great importance. Teachers and text-books are everywhere at command, and none who aim to be educated men should stop short of this amount of linguistic culture, valuable in itself and valuable also as a help to other studies. Greek is less important. The critical study of English is indispensable, and a scientific man is not equipped for his work in life without some knowledge of French and German, in which so many of the results of modern investigation are recorded.

The military instruction required by Congress is likely to give some trouble. In some States, West Virginia, for instance, the agricultural school is to be made a military academy with a thoroughly organized corps of cadets. Probably the permission granted by Congress, on the 28th of July, 1866, to the President of the United States, to detail an officer of the army to act as president, superintendent, or professor in any college having one hundred and fifty students, may lead to some new developments respecting the feasibility of uniting military with scientific studies. An officer of the army, Major Whittlesey, has been recently conferring with officers of colleges in respect to the possibility of providing in them military instruction, and the report of his inquiries is now awaited with interest.

In one institution the opinion is maintained that instruction in the principles of strategy, the laws of military movements, the organization of armies, the power of ordnance, and other

such topics, is likely to be of far more service to the young men, if their services should be called for in time of war, than ordinary drill in a military company. "The 'School of the Soldier" can be mastered in the village militia company, under the orders of an orderly sergeant; but the principles of military science must be taught in a scientific method and by a scientific man. An annual course of lectures, illustrated by diagrams, may therefore give more correct ideas of military tactics, in the higher sense of the word, than any daily system of discipline and drill.

The educational value of museums ought to be constantly in mind in organizing these new institutions. Their influence upon the public is almost as important as upon the students. Each scientific school should not only be a place for the training of boys, but it should be a centre of light and instruction for the entire State, in which shall be collected examples of all interesting natural objects which can be brought together, and to which all the citizens of the State shall resort for information.

This leads us to a final remark. We trust that the managers of the National Schools of Science will feel that a great responsibility rests upon them to maintain these institutions on as elevated a plane as the means at their command will permit. We do not think it likely or desirable that they should train young men to go back and labor with the hoe or the anvil. They are rather to train men by scientific courses of study for the higher avocations of life, and especially to take charge of mines, manufactories, the construction of public works, the conduct of topographical and other scientific surveys, — to be leading scientific men. By and by we shall have industrial schools of a lower grade, in which more elementary and practical instruction will be given, suited to those who expect to labor with their hands behind the plough and at the file. As yet, however, we have not teachers enough to maintain many of such local schools. When our central schools are well in progress, the other schools will follow. Till then, mechanics and farmers must seek the knowledge they desire by the occasional courses of lectures in which the results of modern science may be clearly brought before them. Experience seems to show that the sons of farmers in this country,

if they spend three or four years in acquiring an education, will not return to the homestead except as managers of the paternal estate. They will almost always choose to enter other callings, than to be educated farmers handling the scythe and tending the cattle. If the friends of agricultural colleges expect to train up such laborers, we fear they will be disappointed. If, however, schools of science can be maintained where true science in all its departments is cherished, then the agriculture, the mines, and the manufactures of the country will alike be benefited.

The establishment of these National Schools of Science leaves the field clear for the older colleges to maintain more vigorously than ever the established discipline of Latin and Greek. In this we heartily rejoice. The more the course of study in the academic departments of Harvard and Yale is improved, and the more all the older classical colleges do for the advancement of classical culture, the better will it be for the interests of education. Never, probably, in the history of the country, was it more desirable that the study of History, Law, Political Economy, Philosophy, Literature, and all the humanities should be kept up, and that young men should learn to value the lessons of the past, and to take counsel from the thoughts of the wise men of every age and country. Heretofore the complaint has been, that the classics were the only means of liberal education. Henceforward science will offer its aids to intellectual culture in organized schools. Both classes of institutions will flourish side by side, and each will be strong in the other's strength. The Creator and his laws, man and his development, or, in other words, science and history, alike afford abundant discipline for the mind, and appropriate preparation for the active work of life.